**Year 9 Science PBL Scenarios**

By David Gove CC Attribution License <https://creativecommons.org/licenses/by/4.0/>

1. In an area of suburban Sydney, residents along one street in particular have reported that their gardens have been getting progressively sicker and dying.

Reason: An old petrol station on the corner has sprung a leak in its underground tanks. The old petrol station has closed down and been built upon by a drive through liquor store but the old tanks remain and have rusted through. The petroleum from the leak has travelled along a natural fissure in the ground and has been poisoning the local soil in a row.

1. Residents who live near a coastal lagoon and mangrove have noticed that the local fish life have been becoming more and more scarce. The plants in the area have also been losing leaves more readily.

Reason: The residents disliked the smell coming from the lagoon, which acted as a natural estuarine area. A group went out and dug a channel under the water’s surface to allow the water to drain out to the sea. This meant there was more sea water in the lagoon which made the water more saline… harming the fish and plants.

1. Local bird watchers in a country town have noted that native owls and kites (a small raptor) have been declining in number over the past year. A number have been found that were ill with lethargy and apparent disorientation.

Pesticides used by grain farmers after a mouse plague over the past year have bioaccumulated in the food chain. This has caused the local predatory birds to become sick and die.

1. People who use a neighbourhood park and play area in a new urban development have made complaints that there is an irritating smell which causes asthma to flare up and eyes to water, particularly after heavy rains.

The area is reclaimed land used previously for industrial purposes. Landfill and toxic run off of solvents generates the smell detected from a local park. Some of the solvents are dissolved after heavy rainfall which soak into the ground but evaporate causing the smell.

1. A small inland lake has started to smell stagnant and local toads and frogs are starting to decline in numbers. As a local fishing spot, it is has been noted that less fish appear to be in the lake.

Some residents have been dumping green waste into stormwater drains which feed into the lake. This excess of plant material has decayed in the lake leading the eutrophication meaning that there is less oxygen in the water and tadpoles and fish have been dying.

1. There is a slow moving river in which fish have been found washed up dead onto to the river’s banks. There is a cyan discoloration on the water surface that has also been noticed.

The cyan discolouration is an algal bloom from sewage from a ruptured septic tank from one of the local farms. The algae have released toxins which have been dangerous to fish leading to the fish kill.

1. Tall trees in a gully in a patch of natural bushland have been dying. Low lying plants seem to be unaffected.

Increased irrigation from the local farms is raising the water table and bring up salts from the soils, increasing the salinity of the soil. Tall trees have been dying as their roots are the deepest

1. In a coastline ecosystem, a noticeable number of the local sea birds which frequent the rock platform have been found dead. A significant number of crabs have also been found dead.

The remnants of some industrial containers illegally dumped have ruptured and spilled cadmium compounds into the surrounding water. Heavy metal accumulation from filter feeding shellfish (oysters in particular) were eaten by seabirds causing lethargy and death in many of the local seabirds. Crabs being scavengers also have been ingesting a significant amount of the cadmium which has reached toxic levels.

1. In a shallow warm ocean area, local residents have noticed that there is a significant decline of sea birds and sea turtles. There is a nearby protected island on which no humans live aside from an automated lighthouse and weather station.

Rats have been introduced to the island on a boat when the lighthouse etc was being repaired. They are stealing the eggs of birds and sea turtles leading to population loss.

1. In local river ecosystem, small fish are in decline and trees in the surrounding area are dying. The water itself seems relatively clear.

Acidic runoff (sulfides and nitrates) from a zinc mine long since closed down is acidifying a river/wetland, particularly after heavy rains. The fish are dying as they cannot breed (the acid affects their eggs) and acidification of the soil is killing the trees.

1. Bushwalkers and rock-climbers have noted that eucalypts and other tall plants have been dying in a “band” between a couple of low hills.

The floral deaths have been caused by a herbicide designed for agricultural use which has been used to spray crops in nearby farmland. The pesticide was carried by the winds and blown between the hills which affected the tallest trees in the area.

1. A grazier complains that his land is “dusting” up and he is having problems feeding his cattle and sheep, despite healthy rains in the area over the last year.

Recently cleared bushland (by him or when a new road was built) was shielding his grazing land from prevailing winds and runoff. The combined effects of sheep and cattle hooves as well as the runoff has stripped the most fertile top layers of soil.

1. Residents living close to a wetland have noted that there are an unusually high number of mosquitoes this summer. Although generally harmless, there is the concern that the mosquitoes may carry diseases.

Residential oil dumping down stormwater drains has caused frogs in a local wetland to start to die off as their skin becomes coated with the oil making them unable to breathe. Mosquito larvae have become more prolific as a result and residents are noticing the increase in mosquitoes.

1. Residents have noticed that there are large populations of fruit bats/birds around their parkland residences, which have arrived earlier than the seasonal movements than normal and have stayed for longer. More of them seem to be caught in powerlines and there is the concern that their droppings will damage vehicles parked in the area.

This has been caused by the increased use of a new sports stadium that is interfering with the normal migratory patterns of the birds and bats through excessive sound and light. The sound and light disorients them and more are hitting powerlines. It also provides food as the lights attract insects and people leave scraps which attract animals.

1. A local river in a suburban and industrial area has had numbers of fish wash up along the riverbank. With residents in the area, industries are careful not to dump wastes into the river. This is particularly noticeable after heavy summer rains.

The power plant located upstream uses the water as a coolant, which has warmed the water. Stormwater runoff from the streets has been warmer than the surrounding water from contact with the bitumen streets also warming the water. This warming of river water is causing fish to die, as warmer water is less able to hold dissolved oxygen. Fish are suffocating and dying.

1. Flocks of bats previously in a newly built city centre have been slowly declining. There is substantial parkland to operate as a suitable habitat for the bats.

The recent urbanisation has caused a heat island effect causing high winds at night which is affecting the habitation patterns of local bats. As the ground temperature remains warm longer due to the bitumen surfacing, greater difference with air temperature has allowed the generation of more intense wind.

**Rules for the Environmental Problems Investigations**

Your team works for the NSW Office of Environment and Heritage.

Each team will consist of 3 people. All team members must be from the same class.

Each team will be provided with 100 resource points with which they can use to investigate their scenario. These points can be used in to engage in the following actions:

* Ask a question of an expert (teacher)
* Engage in research on the area (teacher)
* Send out a field researcher to perform an “action”.
* Perform a scientific investigation on the area.

It is important that you think carefully about the questions – the more general the question the more point it will cost. Furious “shotgunning” of questions will all be taken into account and will also cost per question

No extra points will be awarded unless in particularly unusual circumstances.

Depending on the nature of the question or research undertaken, there may be a delay in the response provided. This is how it works in the real world so you will need to be patient.

From the questions and investigations you undertake, you will need to draw a conclusion AND an appropriate solution action which is practical for the situation.

Each team will present their investigation and solution to the group in the next double – March 2

Sample Question

A popular coastal marine reserve is reported to be in decline. Marine animals such as fish are not as abundant and the sea sponges, for which this area is protected, have been dying off slowly. Scuba divers frequent the area and have been reported that the water is becoming less clear.

Reason:

The local council removed a sand bar about a kilometre away that was protecting this marine reserve, as it was a hazard to boats. Silt is washed down the coast that is blocking the sea sponges filter feeding mechanisms and causing them to have less food available. The fish that live in the area and rely on the sea sponges have also disappeared as a result.